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(56) Documents cited
GB 2199308 A GB 2179919 A GB 2092991 A
GB 1320202 A GB 1250985 A US 4763810 A
US 4674651 A US 4572403 A

(58) Field of search
UK CL (Edition K) B8P PAX PP
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(54) Timed medication dispensers

(57) A medication dispenser comprises a container to hold one or more medication articles (e.g. pills, tablets, capsules or the like), the container having an outlet provided with a releaseable closure member 7; and, mounted on or in the container, timing means to provide an output signal at a predetermined time of day and/or after a predetermined time interval to alarm means 3,4 arranged to provide an audible and/or visual alarm in response to said output signal.

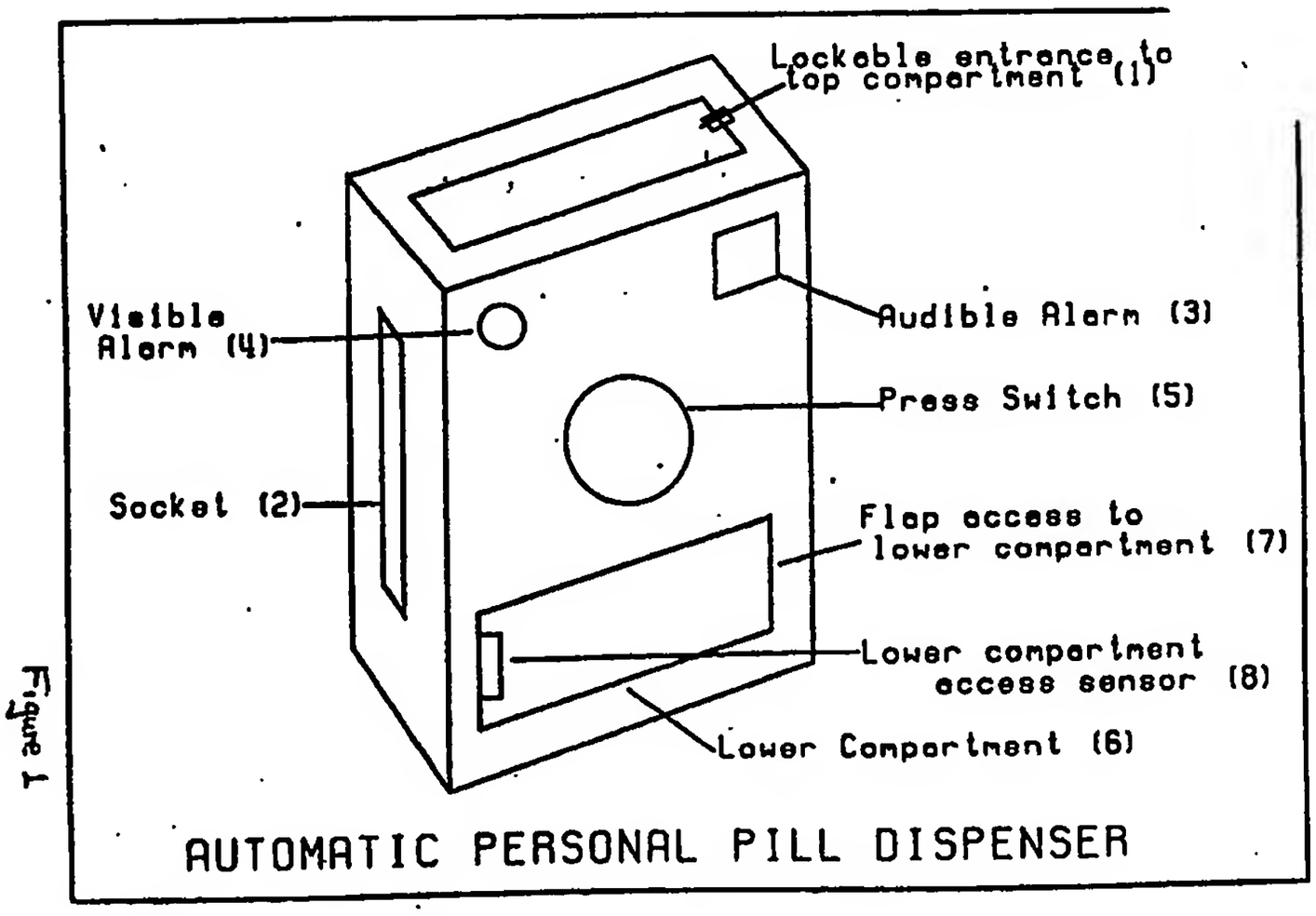

Figure 1

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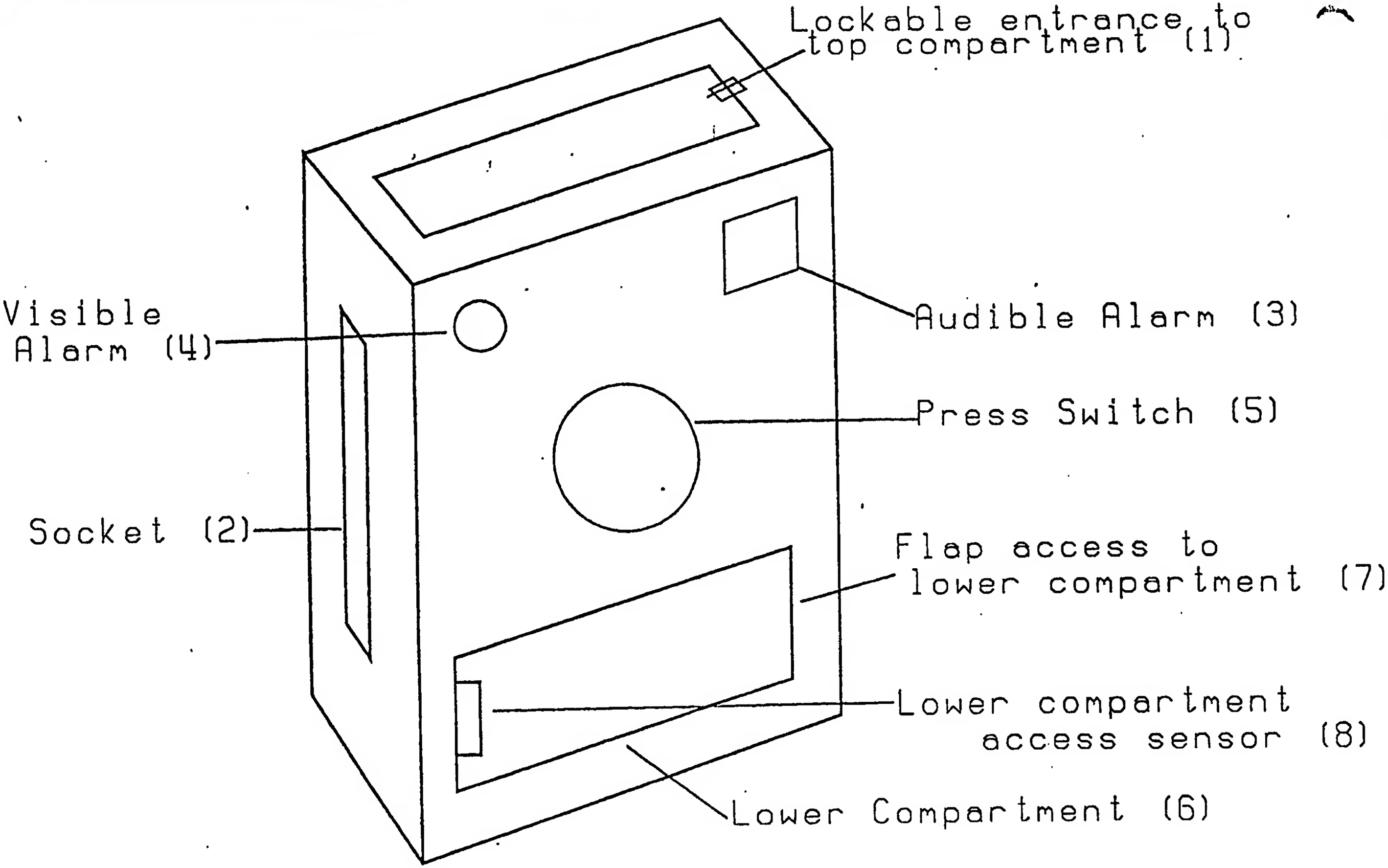

AUTOMATIC PERSONAL PILL DISPENSER

Figure 1

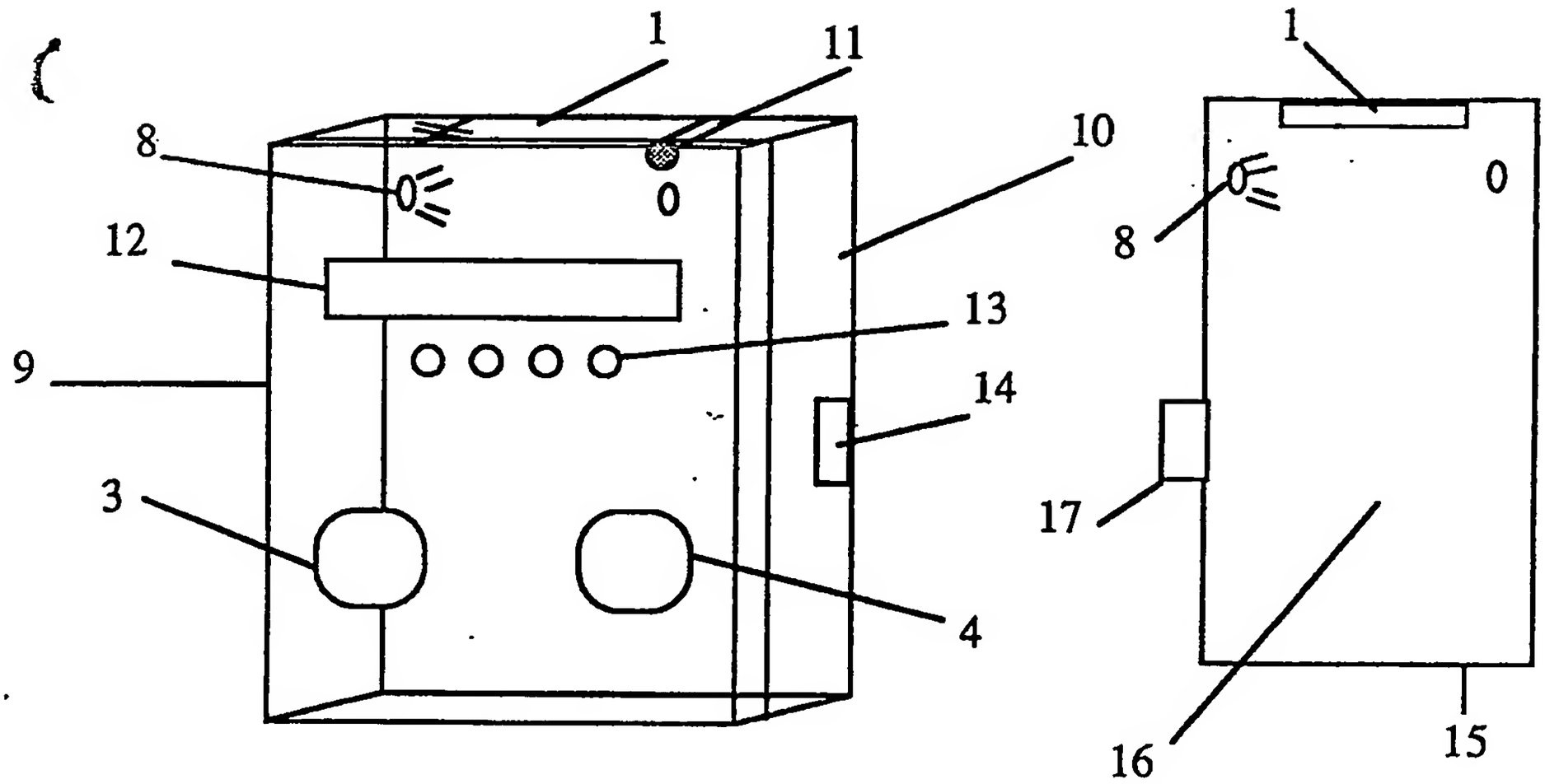

Figure 2

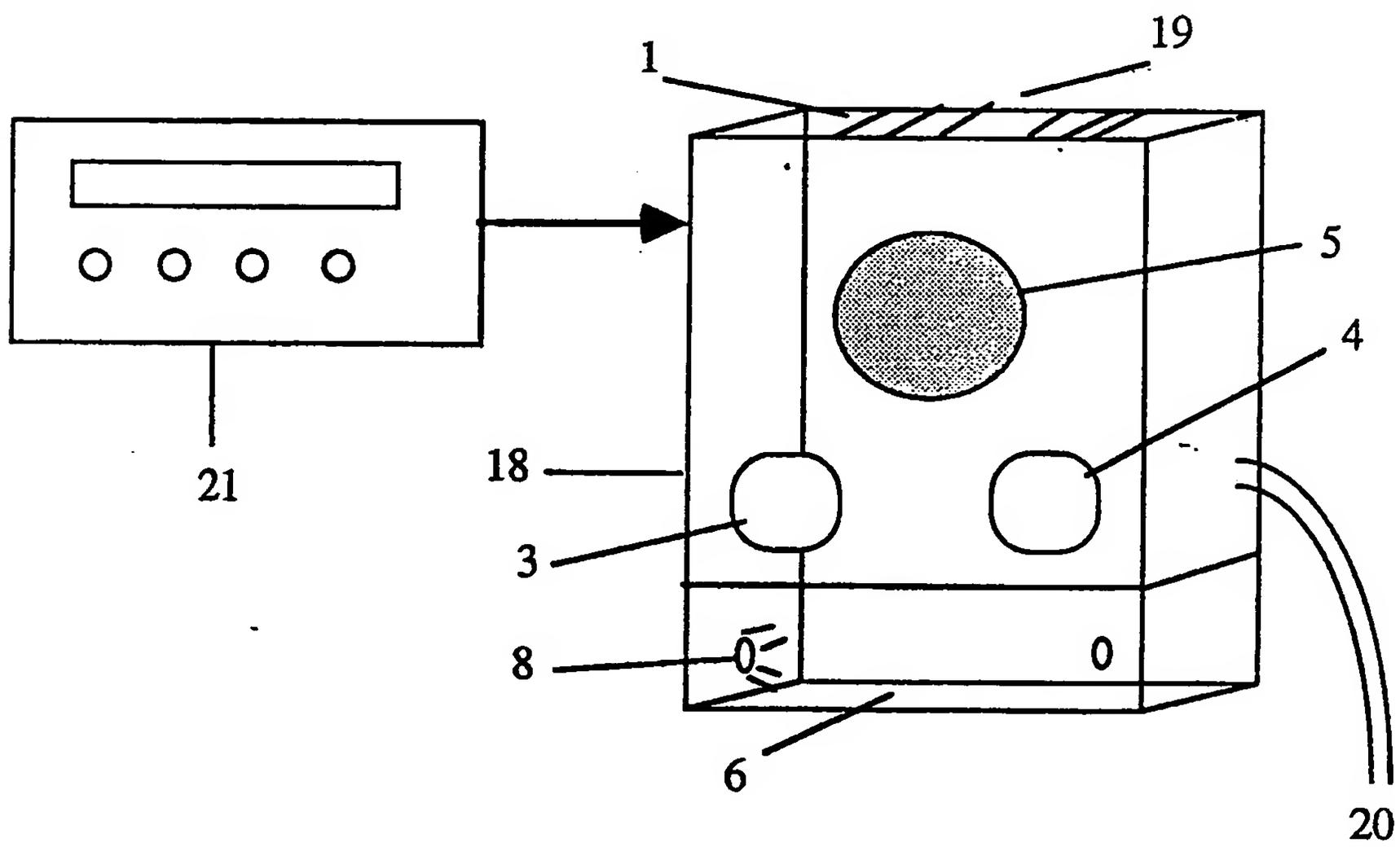

Figure 3

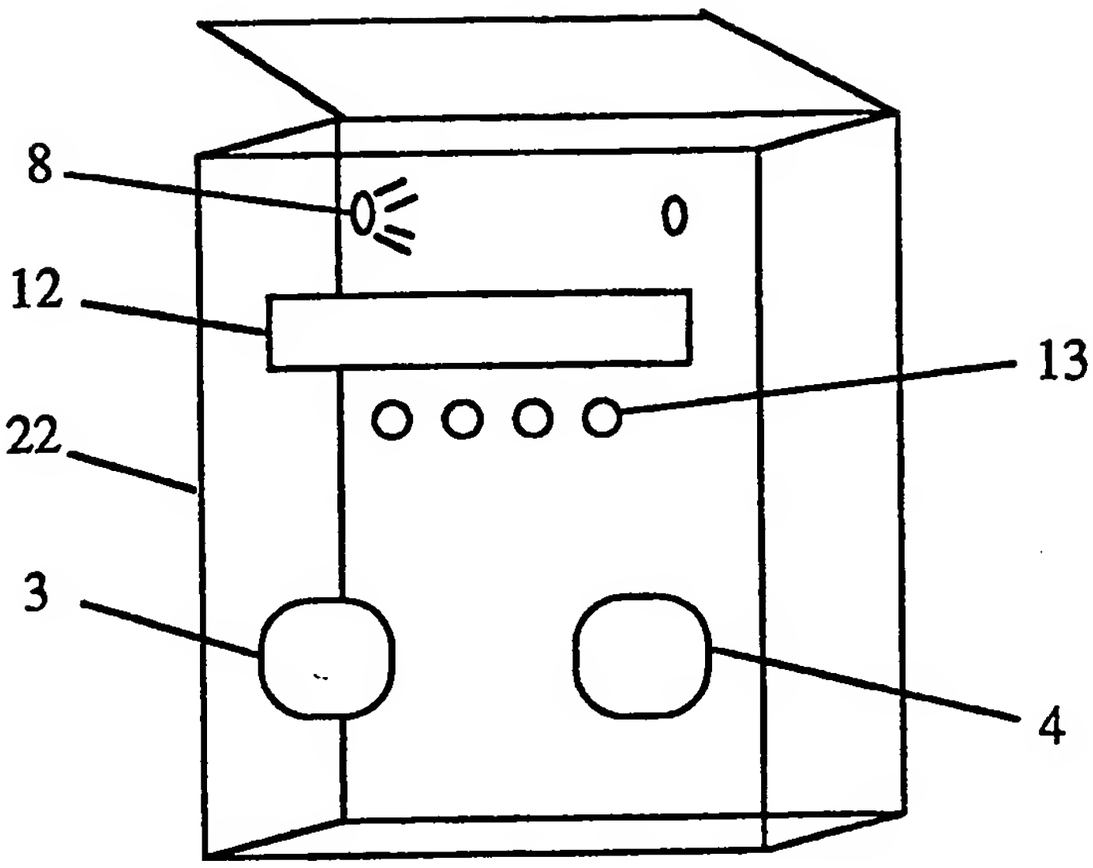

Figure 4

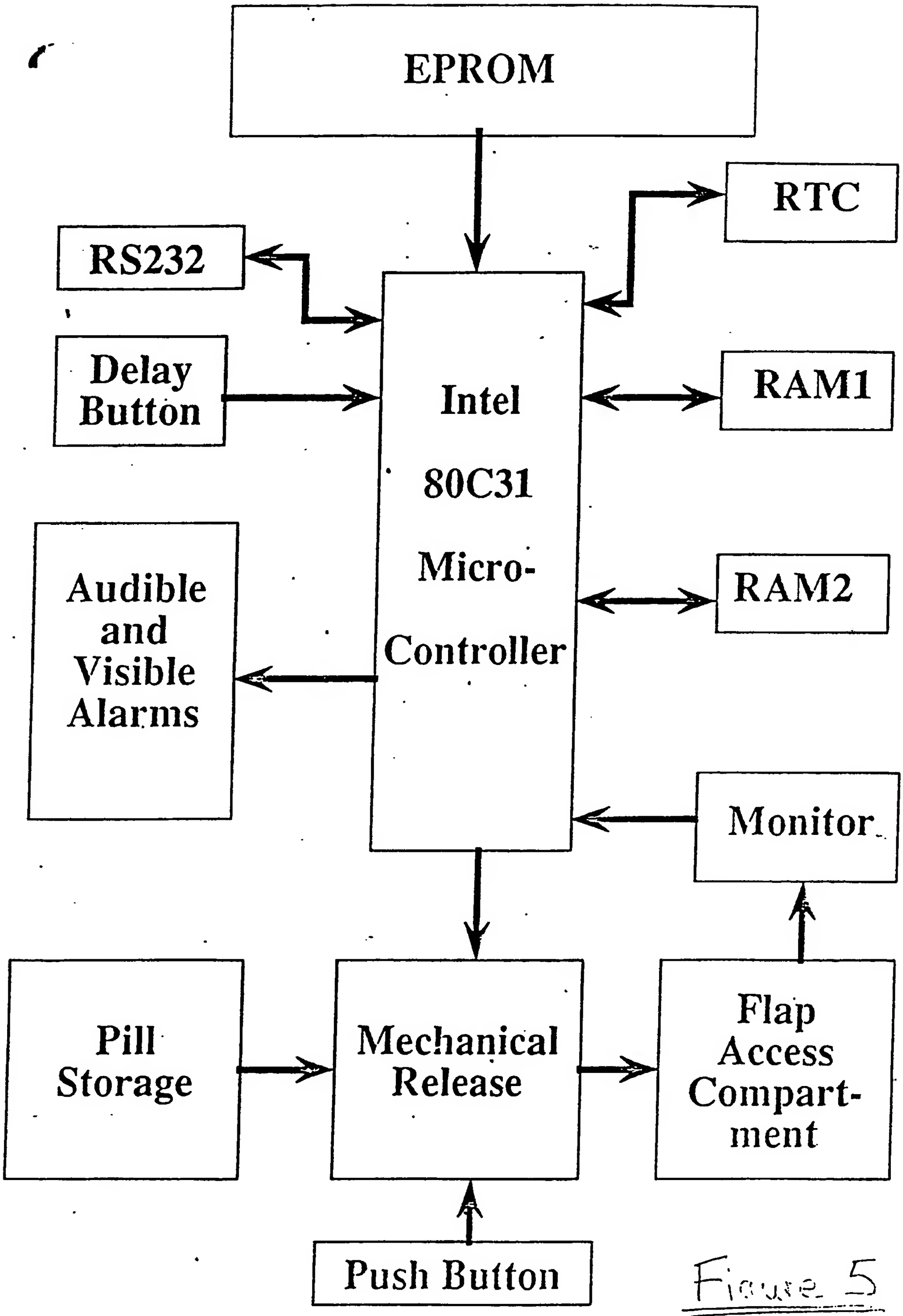
EPROM
RS232
RTC
Delay Button
Intel 80C31 Micro-Controller
RAM1
RAM2
Audible and Visible Alarms
Monitor
Pill Storage
Mechanical Release
Flap Access Compart-ment
Push Button

Figure 5

Medication Dispensing

This invention relates to medication dispensing particularly, but not exclusively, to an Automatic Personal Pill Dispenser ie. means for dispensing pills, tablets, capsules or the like, for an individual person (or animal) to consume.

Taking drugs has become part of our way of life. It is, however, evident that many normal, sensible people default or make mistakes in their treatment. Such actions not only waste money, but can be a potential danger to both the patient and the community, as might occur if diabetic, tuberculous or epileptic patients fail to take their medication in the prescribed manner.

The measurement of drug compliance may be done directly or indirectly. Direct methods involve measuring the blood or urine concentration of the drug, its metabolites or a marker. Unfortunately, this is not applicable to all drugs and the technique is further limited by the rate of drug elimination and the fact that the drug concentration in urine fails to distinguish between over and under dosages. Indirect methods include pill counts and patient interviews, however, neither are particularly satisfactory since they rely on patient honesty and may not demonstrate altered patterns of drug defaulting.

The extent of drug defaulting is difficult to assess, however it does seem that the elderly, the mentally ill and those on long term medication are likely to default. Hospital organised studies found that as many as three quarters of their elderly patients made drug medication errors, and as many as one quarter made potentially serious errors.

The compliance aids available at present are simple to use but require special packaging by the manufacturer, for example with calender blister packs, or are time consuming for the pharmacist, for example the Dossette box.

one aspect of
According to this invention a pill dispenser comprises a container adapted to automatically dispense a predetermined pill at a predetermined time and/or to monitor its removal from the dispenser. The dispenser typically will be loaded with one or more types of pill by the pharmacist who will also program the device to dispense the correct pill at the required times throughout the day. When a pill is to be taken, the dispenser can inform the patient by setting both audible and visible alarms. Preferably, the alarms are switched off by the patient pressing a button and the pill is then released into a compartment in a lower section of the dispenser ready to be removed by the patient. Access to this compartment can be monitored so that a record of any discrepancies between the pill being released and the pill being removed by the patient can be recorded on the dispenser's internal memory. When the patient next visits the doctor, the dispenser's internal memory can be accessed by the doctor so as to obtain an estimate of patient compliance.

The invention is further described by way of some examples with reference to the accompanying drawings which illustrate some possible forms of an automatic personal pill dispenser. A block diagram (see Figure 5) and block description of a possible form the electronics are also included.

Example 1 (See Figure 1)

The dispenser consists of a portable rectangular box with a secureable entrance (1) through which a variety of pills may be entered and securely stored in the top compartment of the dispenser. The dispenser also has an audible alarm (3), a visible alarm (4), a large, easy-to-use, press switch (5) and a lower compartment (6) which is accessed by a flap (7). Access to the lower compartment is monitored by a sensor (8). A socket (2) provides connection to the internal microprocessor and memory. Further internal components include a long term clock, devices to drive the mechanical release mechanism and a high reliability rechargeable battery. The release mechanism allows a particular pill from a selection of pills to be released under total electronic control.

The pills are loaded into the dispenser by the pharmacist through a secureable aperture (1). The pharmacist may then program the dispenser through the use of external hardware, such as a personal computer with dedicated software, by connection to the socket (2), to dispense the correct number and type of pill at the required times. The top compartment may now be secured to prevent unauthorised access to the pills. The dispenser may then be taken away by the patient. When the time comes for the pill to be dispensed the patient is informed by means of an audible alarm (3) and a visible alarm (4). The patient may switch off the alarms by means of the press-switch (5) where by the pill is simultaneously dispensed into the lower compartment of the dispenser (6). The pill may be removed by the patient via the lower compartment access flap (7) which triggers a sensor (8). Any large time discrepancies between when the alarm goes off and when the pill is removed from the dispenser are recorded in detail on memory within the dispenser. When the patient next visits their doctor, the dispenser memory can be interrogated via the socket (2) again through use of external hardware such as a personal computer with dedicated software.

Further features include the dispenser calculating the times the pills should be dispensed using only the time the patient eats breakfast and the number of times the pill is to be taken throughout the day. Also the dispenser can incorporate a delay function so that if the patient is not able to take the pill when requested he/she may be given a 10 minute preparation time. Finally, the dispenser can automatically shut off when the pills go out of date.

Example 2 (see Figure 2)

Example 2 describes the unit as comprising of a portable rectangular box with a front section (9) which contains the relevant electronics, and a rear section (10) which holds the medication. The rear section comprises of a lockable top (1) which can be released by a solenoid (11) being activated, thus allowing access to the medication. Access to the rear compartment (10) is also monitored using a light-beam-breaking circuit (8), so that a value for patient compliance can be obtained. The electronics comprises of a Liquid Crystal Display (12) which displays the time, alarm-times and compliance measurement, a number of small buttons (13) which allow the time and alarm-times to be programmed, a loud buzzer (3) and bright light (4) to alert the user, and a microcontroller to control the workings of the unit . The electronics also controls the solenoid and responds to the light-beam-breaking circuit in the rear section.

The pills are loaded into the rear compartment through the lockable top (1), and the current time and the times medication is to be released are programmed into the unit using the buttons (13). The unit is then shut and started. When the medication time arrives, the user is alerted by the buzzer (3) and light (4), and the solenoid is activated, thus releasing the lid of the rear section to a temporary, partially open, position. If a delay is required, the user can close the lid again and a delay for five minutes will be activated after which the alarms sound again and the cycle is repeated. This can be repeated for up to one hour. To remove the medication, the user releases the catch from the temporary position and has full access to the medication. The top is then shut again in preparation for the next medication time. If the light beam has not been broken (ie. the medication has not been removed), then this is recorded in an internal memory, and a measure of compliance calculated. This value can be displayed to the user on request.

The unit can be adapted for use by the elderly by enlarging the buttons (13) and rear compartment (10) so making use of the device by patients with impaired manual dexterity, easier. The unit should also be adaptable to cater for a variety of pills being required by the same user. This is possible by incorporating a socket (14) in the rear compartment of the unit and separately available rear-compartments (15) which would just comprise of the container (16), solenoid-controlled lid (1), light-beam breaking circuit (8) and a plug (17). The extra rear-compartment could simply plug into the existing rear of the unit as required ; each extra section for each additional type of medication.

Example 3 (See Figure 3)

A further example of the invention would be for use in hospitals. The unit could be incorporated into a patient-bedside unit and so relieve the nurses of the monotonous task of medication distribution. This unit would not have to be portable and could be run from the mains electricity but would be for personal use for each patient.

The dispenser consists of a rectangular box (18) with a securable entrance (1) through which a variety of pills can be entered and securely stored in the top compartments (19). Each type of medication would sit in a separate compartment. The dispenser has an audible (3) and visible (4) alarm and a connection to the local nurses station (20). The unit also has a large press switch (5) and a lower compartment (6) into which the medication falls. Access to the lower compartment is monitored by a light-beam breaking circuit (8). The unit is programmed by connection of a separate, external unit (21) which consists of the electronics required to prompt the nurse for medication dispensation times.

The medication is loaded into the unit by a nurse and then programmed using the separate plug-in unit (21). The unit lies by the patient's bedside and when the medication time is reached, the alarms (3 and 4) are activated and the large push button (5) release mechanism released. To switch off the alarms, the large button (5) is pressed by the patient. This also dispenses the medication into the lower compartment (6) from where it can be removed. When the medication time is reached the nurse is also alerted so that verification of the medication being taken can be done. If the medication is not removed from the lower compartment within ten minutes, an alarm sounds in the nurses station so that he or she can tend to the situation.

Example 4 (see Figure 4)

Given the current state of electronics, it would be feasible to incorporate the unit into the medication packaging. Hence, the unit would be in the form of a basic, disposable medication box (22) with all the necessary electronics incorporated. The electronics comprises of a Liquid Crystal Display (12) which displays the time, alarm-times and compliance measurement, a number of small buttons (13) which allow the unit time and alarm-times to be programmed, a loud buzzer (3) and bright light (4) to alert the user, and a microcontroller to control the workings of the unit . The electronics can also control access to the medication and may respond to the light-beam-breaking circuit (8) in the packaging which monitors if the medication has been removed.

The medication would be bought by the patient in its original packaging (22) which would include the alarm system and access release mechanism. The unit can then be programmed by the patient using the buttons (13) and the Liquid Crystal Display (12). When the medication is due to be taken the patient is alerted by the loud buzzer (3) and bright light (4) and he/she can then gain access to the medication. When all the medication has been taken, the user can throw the entire unit away, or hand it back to the pharmacist for re-cycling.

Block Description (See Figure 5)

The following block description describes one example of the form the electronics in the unit may take. The electronics described is for the unit described in Example 1.

Microcontroller

A low cost microcontroller forms the centre of the unit. The microcontroller controls all the workings of the unit under program control.

EPROM

The EPROM (Electrically Programmable Read Only Memory) contains the program which the microcontroller runs.

RTC

The Real Time Clock keeps the time and date which is programmed by the user. The RTC can also be used to generate an alarm signal at a predetermined time.

RAM1

RAM1 (Random Access Memory) stores the alarm times programmed by the user.

RAM2

RAM2 stores the compliance information, ie. the time and date the medication was not taken correctly.

Monitor

The monitor unit consists of a light-beam breaking circuit (8 in Figures 1-4) which detects whether the medication has been removed from the unit. If the medication is not removed then the time and date are recorded in RAM2, and a measure for compliance can be calculated.

Flap Access Compartment

The lower compartment (6 in Figure 1) into which the medication is dispensed, has access to it via a flap.The flap (7 in Figure 1) ensures that the medication does not fall out of the unit.

Mechanical Release

The mechanical release mechanism consists of the solenoid (11) and related mechanical hardware. The mechanism should dispense the medication into the lower compartment (6) when activated by the microcontroller and the push button (5).

Push Button

When pushed, this button (5) switches off the alarms and releases the medication into the lower compartment (6).

Pill Storage

The medication is stored in one or more separate pill-box sized compartments (15 and 19 in Figures 1-4).

Audible and Visible Alarms

A loud buzzer (3) and bright Light Emitting Diode (4) alert the user to the times the medication are to be taken. Both are controlled by the microcontroller.

Delay Button

When pressed, the delay button switches off the alarms for a ten minute period.

RS232

The RS232 Serial link (2) enables the unit to be accessed by a personal computer. This enables the time and alarm times to be programmed by the pharmacist and a measure of compliance to be read by the doctor.

CLAIMS

1. Medication dispensing means comprising:

a container to hold one or more medication articles (e.g. pills, tablets, capsules or the like), the container having an outlet provided with a releasable closure member; and, mounted on or in the container,

timing means to provide an output signal at a predetermined time of day and/or after a predetermined time interval to alarm means arranged to provide an audible and/or visual alarm in response to said output signal.

2. Medication dispensing means according to Claim 1 and further comprising closure member opening means responsive to said output signal automatically to dispense or permit access to the one medication article or to one or more of the said medication articles.

3. Medication dispensing means according to Claim 1 or Claim 2 and further comprising means to monitor the removal of the medication article(s) from the container via said outlet.

4. Medication dispensing means according to Claim 3 and further comprising means to record on an internal memory the removal of the medication article(s) from the container via said outlet, thereby to provide a measure of the user's compliance with a prescribed or otherwise pre-ordained medication taking regimen.

5. Medication dispensing means substantially as herein described with reference to and/or as illustrated in Fig 1 of the accompanying drawings.

6. Medication dispensing means substantially as herein described with reference to and/or as illustrated in Fig 2 or Fig 3 or Fig 4 of the accompanying drawings.

7. Medication dispensing means substantially as herein described and incorporating an electronic circuit substantially as herein described with reference to and/or as illustrated in Fig 5 of the accompanying drawings.

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